Cerebral palsy research news

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Interventions and Management

1. Reliability and Validity of a New Diagnostic Device for Quantifying Hemiparetic Arm Impairments: An Exploratory Study
Levinia Van der Velden, Joyce Benner, Bram Onneweer, Claudia Haarman, Ruud Selles, Gerard Ribbers, Marij Roebroeck

J Rehabil Med. 2022 Apr 1. doi: 10.2340/jrm.v54.12. Online ahead of print.

Objective: To assess test-retest reliability and validity of a new diagnostic device, the Shoulder Elbow Perturbator, to quantify muscle weakness, abnormal synergy, (muscle activity-related) spasticity, and changes in viscoelastic joint properties of the elbow. Subjects: Stroke patients, adults with cerebral palsy and healthy controls. Methods: Test-retest reliability was evaluated using intra-class correlations (ICC) and assessment of measurement error. The device's validity was evaluated by demonstrating differences between patients and healthy controls, and correlations of spasticity and abnormal synergy outcomes using the clinical Modified Tardieu Scale, the Fugl-Meyer Assessment, and the Test of Arm Selective Control. Results: Reliability was excellent, with an ICC > 0.75 for synergy and ICCs > 0.90 for all other impairments, with relatively small measurement errors. Validity was confirmed by group differences between patients and healthy controls for muscle weakness, spasticity, and viscoelastic joint properties, but not for abnormal synergy. Correlation analysis with clinical scales confirmed validity for spasticity, while, for synergy, correlations were found in the patients with stroke, but not those with cerebral palsy. Conclusion: This new diagnostic device is a reliable and valid instrument to assess multiple upper limb impairments in patients with neurological conditions, supporting its use in clinical practice. Further studies are needed to confirm these findings.

PMID: 35362087

2. Walking activity after multilevel orthopedic surgery in children with cerebral palsy
Chris Church, Isabel Biermann, Nancy Lennon, John D Henley, Stephanie Butler, Tim Niiler, Michael Wade Shrader, Freeman Miller, Jason J Howard

Dev Med Child Neurol. 2022 Mar 26. doi: 10.1111/dmcn.15228. Online ahead of print.

Aim: To determine how surgical burden and preoperative factors affect the recovery of walking activity after multilevel orthopedic surgery (MLS). Method: In this retrospective study, inclusion criteria were a diagnosis of cerebral palsy, MLS, and walking activity monitoring using a StepWatch device within 12 months pre-MLS and 24 months post-MLS. The outcome measure was total mean strides per day normalized to age and Gross Motor Function Classification System level. Pre- and postoperative walking activity were compared using unpaired t-tests; the effects of preoperative predictors and surgical burden on the recovery of walking activity were evaluated using regression analysis. Results: Participants included 178 children (mean age 12 years 10 months [SD 8 years 7 months; range 4-20 years]; 91 males, 87 females). On average, children returned

to baseline walking activity 3 months after low-burden surgery and 1 year 2 months after high-burden surgery. Postoperative walking activity was higher for children who had surgery at a younger age and those with a higher preoperative mobility function. Interpretation: The burden of MLS was found to be inversely related to the time to recovery of postoperative walking activity. These findings provide evidence to help clinicians set expectations for return to function post-MLS. Further study is necessary to investigate the impact of postoperative factors on walking activity recovery.

PMID: 35338776

3. Ankle Dorsiflexor Function after Gastrocsoleus Lengthening in Children with Cerebral Palsy: A Literature Review
Nicholas Sclavos, Norine Ma, Elyse Passmore, Pam Thomason, H Kerr Graham, Erich Rutz

Review Medicina (Kaunas). 2022 Mar 2;58(3):375. doi: 10.3390/medicina58030375.

Background and Objectives: Ambulant children with cerebral palsy can demonstrate persistent "foot drop" after successful gastrocsoleus lengthening (GSL) surgery for equinus deformity. This may be due to inadequate strength and/or selective motor control of the ankle dorsiflexor muscles. A procedure has been developed to reduce foot drop-Tibialis Anterior Tendon Shortening (TATS), to be performed in conjunction with GSL. However, it is currently unclear how ankle dorsiflexor function changes after surgery and which children could benefit from TATS. This review summarises changes in ankle dorsiflexor function after GSL for equinus, as reported in the literature. Methods: A search was performed of the Medline, Embase and PubMed databases from 1980 to 5 March 2021. Keywords included "cerebral palsy", "equinus deformity", "orthopedic procedures" and "gait analysis". The search identified 1974 studies. Thirty-three cohort studies met the inclusion criteria for this review. Results: Twenty-two studies reported improvement in swing phase ankle dorsiflexion kinematics, after GSL. There was also evidence that clinical measures of ankle dorsiflexor strength improved after surgery. Four studies reported changes in selective motor control, with mixed results across the studies. Conclusions: There is good evidence that swing phase ankle dorsiflexion improves after GSL surgery. Although, there is limited evidence that this correlates with reduced foot drop or diminished need for an ankle-foot orthosis. Future research should be prospective, randomised, include a large sample size, and should focus on identifying the optimal candidates for TATS.

PMID: 35334551

4. Functional resistance training methods for targeting patient-specific gait deficits: A review of devices and their effects on muscle activation, neural control, and gait mechanics
Edward P Washabaugh, Chandramouli Krishnan

Review Clin Biomech (Bristol, Avon). 2022 Mar 18;94:105629. doi: 10.1016/j.clinbiomech.2022.105629. Online ahead of print.

Background: Injuries to the neuromusculoskeletal system often result in weakness and gait impairments. Functional resistance training during walking-where patients walk while a device increases loading on the leg-is an emerging approach to combat these symptoms. However, there are many methods that can be used to resist the patient, which may alter the biomechanics of the training. Thus, all methods may not address patient-specific deficits. Methods: We performed a comprehensive electronic database search to identify articles that acutely (i.e., after a single training session) examined how functional resistance training during walking alters muscle activation, gait biomechanics, and neural plasticity. Only articles that examined these effects during training or following the removal of resistance (i.e., aftereffects) were included. Findings: We found 41 studies that matched these criteria. Most studies (24) used passive devices (e.g., weighted cuffs or resistance bands) while the remainder used robotic devices. Devices varied on if they were wearable (14) or externally tethered, and the type of resistance they applied (i.e., inertial [14], elastic [8], viscous [7], or customized [12]). Notably, these methods provided device-specific changes in muscle activation, biomechanics, and spatiotemporal and kinematic aftereffects. Some evidence suggests this training results in task-specific increases in neural excitability. Interpretation: These findings suggest that careful selection of resistive strategies could help target patient-specific strength deficits and gait impairments. Also, many approaches are low-cost and feasible for clinical or in-home use. The results provide new insights for clinicians on selecting an appropriate functional resistance training strategy to target patient-specific needs.

PMID: 35344781

5. Infantile Cocktail of Erythropoietin and Melatonin Restores Gait in Adults Rats with Preterm Brain Injury
Lauren Jantzie, Sankar Muthukumar, Yuma Kitase, Vikram Vasan, Mohammed A Fouda, Sarah Hamimi, Christopher Burkhardt, Vera Joanna Burton, Gwendolyn Gerner, Joseph Scafidi, Xiaobu Ye, Frances J Northington, Shenandoah Robinson

Dev Neurosci. 2022 Mar 31. doi: 10.1159/000524394. Online ahead of print.

Cerebral palsy (CP) is the most common cause of physical disability for children worldwide. Many infants and toddlers are not diagnosed with CP until they fail to achieve obvious motor milestones. Currently, there are no effective pharmacologic interventions available for infants and toddlers to substantially improve their trajectory of neurodevelopment. Because children with CP from preterm birth also exhibit a sustained immune system hyper-reactivity, we hypothesized that neuro-immunomodulation with a regimen of repurposed endogenous neurorestorative medications, erythropoietin (EPO) and melatonin (MLT) could improve this trajectory. Thus, we administered EPO+MLT to rats with CP during human infant-toddler equivalency to determine whether we could influence gait patterns in mature animals. After a prenatal injury on embryonic day 18 (E18) that mimics chorioamnionitis at ~25 weeks human gestation, rat pups were born and raised with their dam. Beginning on postnatal day 15 (P15), equivalent to human infant ~1 year, rats were randomized to receive either a regimen of EPO+MLT or vehicle (sterile saline) through P20. Gait was assessed in young adult rats at P30 using computerized digital gait analyses including videography on a treadmill. Results indicate that gait metrics of young adult rats treated with an infantile cocktail of EPO+MLT were restored compared to vehicle-treated rats ($p<0.05$), and similar to sham controls. These results provide reassuring evidence that pharmacological interventions may be beneficial to infants and toddlers who are diagnosed with CP well after the traditional neonatal window of intervention.

PMID: 35358965

6. Caregivers' Perceptions of a High Repetition Sit-To-Stand Exercise Program for Children with Cerebral Palsy Who Have Mobility Limitations
Sirawee Chaovalit, Karen J Dodd, Nicholas F Taylor

Phys Occup Ther Pediatr. 2022 Mar 29;1-13. doi: 10.1080/01942638.2022.2057208. Online ahead of print.

Aims: To explore caregiver perceptions about the outcomes and feasibility of a high repetition sit-to-stand home-based exercise program on themselves and their children with cerebral palsy who have mobility limitations. Methods: Face-to-face semi-structured interviews were conducted with 19 caregivers (17 women, mean age 39 y 6 mo (SD 8 y 4 mo) of 19 children with cerebral palsy (10 males, mean age 7 y 2 mo (SD 2 y 1 mo) classified as level III (n = 8) or IV (n = 11) on the Gross Motor Function Classification System. The children had completed a 6-week task-specific sit-to-stand exercise program. Each week a physical therapist and caregivers supervised the program: twice by the physical therapist and three times by the caregivers. Interviews were completed immediately after program completion, and transcripts were analyzed using a process of inductive thematic analysis within an interpretive description framework. Results: Themes were: (1) caregivers saw positive changes in their children from completing the program, (2) seeing positive changes gave caregivers hope that their child could develop with further training, and (3) the program was feasible to complete. Conclusions: Caregivers perceived positive changes in their children and expressed increased hope for their child's future after a high repetition sit-to-stand exercise program, suggesting the program is feasible with caregiver supervision.

PMID: 35350951

7. Dynamic Standing Exercise Using the Innowalk Device in Patients with Genetic and Acquired Motor Impairments
Ana Pekanovic, Walter Strobl, Ulrich Hafkemeyer, Jens Kleine, Peter Bernius, Rolf Burghardt, Caroline Schmidt-Lucke

J Rehabil Med. 2022 Apr 1. doi: 10.2340/jrm.v54.23. Online ahead of print.

Objective: For individuals with motor impairments, dynamic standing has been proposed as an opportunity for regular daily physical activity. The aim of this study was to analyse patient characteristics, indications, intensity of usage, desired objectives and outcomes of dynamic standing in daily clinical practice in order to form the basis for research regarding this treatment option. Setting: Data were analysed from standardized questionnaires completed prospectively before supply of a home-based

medical device for dynamic standing (Innowalk; Made for Movement GmbH, Langenhagen, Germany) and at the time of individual adaptations. Participants: In a retrospective chart analysis, records of 46 patients (50% cerebral palsy; 50% diverse syndromes) were evaluated. Intervention: The Innowalk had been prescribed for either home-based use (n = 31), in therapeutic institutions (n = 8), or other settings (n = 7). Dynamic standing was performed for 10-30 min as a single session (n = 8) or for 20-60 min 11 [4-21] weeks in 36 patients. Results: Improvements were found for: passive assisted motion (79%), stimulation of intestinal functions (71%), body stability (64%), joint mobility (56%), secure means of allowing supine position (52%), and revision of abnormal motion patterns (48%). Conclusion: Thus, this systematic approach shows usage patterns, indications, desired goals and clinical outcome of dynamic standing in daily clinical practice and forms the basis for the design of a prospective, randomized controlled trial.

PMID: 35362086

8. Use of Frame Running for Adolescent Athletes With Movement Challenges: Study of Feasibility to Support Health and Participation
Theresa Sukal-Moulton, Tara Egan, Larke Johnson, Crystal Lein, Deborah Gaebler-Spira

Front Sports Act Living. 2022 Mar 9;4:830492. doi: 10.3389/fspor.2022.830492. eCollection 2022.

Children and adolescents with movement challenges have lower instances of physical activity and longer time spent in sedentary behaviors compared to children with typical development. The purpose of this study was to investigate the feasibility of a sport-based youth development running program modified for accessibility using a running frame and to evaluate initial evidence for its efficacy on endurance and functional strength. We completed four 8-week seasons (2-3 times per week) in a combination of 3 different formats by season: online remote (winter and spring), in person in a community park (winter, spring, and summer), and in person in an afterschool setting (autumn). Participants included 13 athletes (average age 14.46 years, range 8-18 years, 4 females), who collectively completed 22 season blocks. Diagnoses included cerebral palsy (n = 10), arthrogryposis (n = 1), Dandy-Walker malformation (n = 1), and transverse myelitis (n = 1). In all settings, participants engaged in activities of social emotional learning, cardiovascular endurance, and muscle strengthening in a progressive manner. We found that each season format was feasible to administer with high attendance rates (76-97%) and positive qualitative feedback from athletes. In addition, promising average improvements in motor performance across a season (6 min frame running test, 170 m; timed up and go test, 8.44 s; five times sit to stand, 14.1 s; and Goal Attainment Scale, t = 65.01) were identified in the pilot data of this non-randomized cohort. Training in any of the proposed settings with an overall goal of completing a community race in a running frame is feasible and warrants further study.

PMID: 35356095

9. Speech treatment for Hebrew-speaking adolescents and young adults with developmental dysarthria: A comparison of mSIT and Beatalk
Micalle Carl, Erika S Levy, Michal Icht

Int J Lang Commun Disord. 2022 Apr 1. doi: 10.1111/1460-6984.12715. Online ahead of print.

Background: Individuals with developmental dysarthria typically demonstrate reduced functioning of one or more of the speech subsystems, which negatively impacts speech intelligibility and communication within social contexts. A few treatment approaches are available for improving speech production and intelligibility among individuals with developmental dysarthria. However, these approaches have only limited application and research findings among adolescents and young adults. Aims: To determine and compare the effectiveness of two treatment approaches, the modified Speech Intelligibility Treatment (mSIT) and the Beatalk technique, on speech production and intelligibility among Hebrew-speaking adolescents and young adults with developmental dysarthria. Methods & procedures: Two matched groups of adolescents and young adults with developmental dysarthria participated in the study. Each received one of the two treatments, mSIT or Beatalk, over the course of 9 weeks. Measures of speech intelligibility, articulatory accuracy, voice and vowel acoustics were assessed both pre- and post-treatment. Outcomes & results: Both the mSIT and Beatalk groups demonstrated gains in at least some of the outcome measures. Participants in the mSIT group exhibited improvement in speech intelligibility and voice measures, while participants in the Beatalk group demonstrated increased articulatory accuracy and gains in voice measures from pre- to post-treatment. Significant increases were noted post-treatment for first formant values for select vowels. Conclusions & implications: Results of this preliminary study are promising for both treatment approaches. The differentiated results indicate their distinct application to speech intelligibility deficits. The current findings also hold clinical significance for treatment among

adolescents and young adults with motor speech disorders and application for a language other than English. What this paper adds: What is already known on the subject Developmental dysarthria (e.g., secondary to cerebral palsy) is a motor speech disorder that negatively impacts speech intelligibility, and thus communication participation. Select treatment approaches are available with the aim of improving speech intelligibility in individuals with developmental dysarthria; however, these approaches are limited in number and have only seldomly been applied specifically to adolescents and young adults. What this paper adds to existing knowledge The current study presents preliminary data regarding two treatment approaches, the mSIT and Beatalk technique, administered to Hebrew-speaking adolescents and young adults with developmental dysarthria in a group setting. Results demonstrate the initial effectiveness of the treatment approaches, with different gains noted for each approach across speech and voice domains. What are the potential or actual clinical implications of this work? The findings add to the existing literature on potential treatment approaches aiming to improve speech production and intelligibility among individuals with developmental dysarthria. The presented approaches also show promise for group-based treatments as well as the potential for improvement among adolescents and young adults with motor speech disorders.

PMID: 35363414

10. Intervention for swallowing problems in adults with cerebral palsy
You Gyoung Yi

Dev Med Child Neurol. 2022 Mar 29. doi: 10.1111/dmcn.15230. Online ahead of print.

PMID: 35352340

11. Malnutrition and nutritional deficiencies in children with cerebral palsy: a systematic review and meta-analysis
D C G da Silva, M de Sá Barreto da Cunha, A de Oliveira Santana, A M Dos Santos Alves, M Pereira Santos

Review Public Health. 2022 Mar 24;205:192-201. doi: 10.1016/j.puhe.2022.01.024. Online ahead of print.

Objectives: This systematic review study and meta-analysis sought to estimate the prevalence of malnutrition and nutritional deficiencies in children with cerebral palsy (CP). Study design: This is a systematic review and meta-analysis. Methods: The systematic review was conducted according to the PRISMA guidelines. The articles were chosen using the PubMed, Embase, Scopus, Web of Science, Cochrane Library, SciELO, and Lilacs databases and the bibliographical reference lists of the articles. No limitations were placed on the time of publication, but the articles had to include children from 0 to 18 years old with CP who presented the prevalence of malnutrition and nutritional deficiencies. The methodological quality of the articles was assessed using the verification list for analytical cross-sectional studies, the Newcastle-Ottawa scale, and the Cochrane Collaboration tool for randomized studies. The meta-analysis of proportions was conducted based on the prevalence data for malnutrition or nutritional deficiencies. The study is registered in PROSPERO under CRD number 42020175068. Results: Sixty-seven articles (N = 453,804) published between 1986 and 2019 were included. Most of the articles presented a low risk of bias and no publication was excluded for quality reasons. The most widely used anthropometric index for diagnosing nutritional status was weight-to-age and the estimated prevalence of malnutrition was 40% (95% CI = 28.0-53.0). Nutrient deficiency was investigated by nine publications, with hypocalcemia and reduced serum concentrations of zinc, copper, and vitamin D being reported the most. Conclusions: We found a high rate of malnutrition in the population in this review, moreover, we suggest that some nutritional deficiencies are associated with food deficit and that the socio-economic and age factors of these children may relate with the poor nutritional outcome. This makes monitoring and personalized nutritional management necessary, in accordance with the characteristics and particularities of children with CP.

PMID: 35339939

12. Nutrition Interventions for Children with Cerebral Palsy in Low- and Middle-Income Countries: A Scoping Review
Israt Jahan, Risad Sultana, Mohammad Muhit, Delwar Akbar, Tasneem Karim, Mahmudul Hassan Al Imam, Manik Chandra Das, Hayley Smithers-Sheedy, Sarah McIntyre, Nadia Badawi, Gulam Khandaker

Review Nutrients. 2022 Mar 12;14(6):1211. doi: 10.3390/nu14061211.

Background: Malnutrition is substantially higher among children with cerebral palsy (CP) in low- and middle-income countries (LMICs) when compared with the general population. Access to appropriate interventions is crucial for better management of malnutrition and nutritional outcomes of those children. We aimed to review the existing evidence on nutrition interventions for children with CP in LMICs. Methods: Online databases, i.e., PubMed and Scopus, and Google Scholar were searched up to 10 January 2022, to identify peer-reviewed publications/evidence on LMIC focused nutritional management guidelines/ interventions. Following title screening and abstract review, full articles that met the inclusion/exclusion criteria were retained for data charting. Information about the study characteristics, nutrition interventions, and their effectiveness were extracted. Descriptive data were reported. Results: Eight articles published between 2008 and 2019 were included with data from a total of n = 252 children with CP (age range: 1 y 0 m-18 y 7 m, 42% female). Five studies followed experimental design; n = 6 were conducted in hospital/clinic/center-based settings. Four studies focused on parental/caregiver training; n = 2 studies had surgical interventions (i.e., gastrostomy) and n = 1 provided neurodevelopmental therapy feeding intervention. Dietary modification as an intervention (or component) was reported in n = 5 studies and had better effect on the nutritional outcomes of children with CP compared to interventions focused on feeding skills or other behavioral modifications. Surgical interventions improved nutritional outcomes in both studies; however, none documented any adverse consequences of the surgical interventions. Conclusion: There is a substantial knowledge gap on nutrition interventions for children with CP in LMICs. This hinders the development of best practice guidelines for the nutritional management of children with CP in those settings. Findings suggest interventions directly related to growth/feeding of children had a better outcome than behavioral interventions. This should be considered in planning of nutrition-focused intervention or comprehensive services for children with CP in LMICs.

PMID: 35334869

13. Embracing the Nutritional Assessment in Cerebral Palsy: A Toolkit for Healthcare Professionals for Daily Practice
Carolina Pinto, Rute Borrego, Mafalda Eiró-Gomes, Inês Casimiro, Ana Raposo, Teresa Folha, Daniel Virella, Ana Catarina Moreira

Nutrients. 2022 Mar 11;14(6):1180. doi: 10.3390/nu14061180.

Background: Nutritional status assessment (NSA) can be challenging in children with cerebral palsy (CP). There are high omission rates in national surveillance reports of weight and height information. Alternative methods are used to assess nutritional status that may be unknown to the healthcare professionals (HCP) who report these children. Caregivers experience challenges when dealing with feeding problems (FP) common in CP. Our aim was to assess the difficulties in NSA which are causing this underreport and to create solutions for registers and caregivers. Methods: An online questionnaire was created for registers. Three meetings with HCP and caregivers were held to discuss problems and solutions regarding NSA and intervention. Results: HCP mentioned difficulty in NSA due to a lack of time, collaboration with others, equipment, and childrens' motor impairment. Caregivers experienced difficulty in preparing nutritious meals with adapted textures. The creation of educational tools and other strategies were suggested. A toolkit for HCP was created with the weight and height assessment methods described and other for caregivers to deal with common FP. Conclusions: There are several difficulties experienced by HCP that might be overcome with educational tools, such as a toolkit. This will facilitate nutritional assessment and intervention and hopefully reduce underreporting.

PMID: 35334837

14. Spasticity-related pain in children/adolescents with cerebral palsy. Part 1: Prevalence and clinical characteristics from a pooled analysis
Florian Heinen, Michaela Bonfert, Petr Kaňovský, A Sebastian Schroeder, Henry G Chambers, Edward Dabrowski, Thorin L Geister, Angelika Hanschmann, Michael Althaus, Marta Banach, Deborah Gaebler-Spira

J Pediatr Rehabil Med. 2022 Mar 24. doi: 10.3233/PRM-220011. Online ahead of print.

Purpose: A large prospective database from three Phase 3 studies allowed the study of spasticity-related pain (SRP) in pediatric cerebral palsy (CP). Methods: Baseline (pretreatment) SRP data occurring during different activities in children/adolescents (aged 2-17 years, ambulant/nonambulant) with uni-/bilateral spastic CP was obtained using the Questionnaire on Pain caused by Spasticity (QPS; six modules specific to spasticity level [lower limb (LL) or upper limb (UL)] and type of respondent [child/ adolescent, interviewer, or parent/caregiver]). Results: At baseline, 331 children/adolescents with LL- and 155 with UL-spasticity completed at least one key item of their modules; LL/UL QPS modules of parent/caregivers were at least partially

completed (key items) by 841/444 parents/caregivers. SRP with at least one activity at baseline was self-reported in 81.9% /69.7% (LLs/ULs) of children/adolescents with spasticity. Parents/caregivers observed LL/UL SRP behaviors in 85.9% /77.7% of their children, with multiple body regions affected. SRP negatively affected the great majority of the children in various ways. Child/adolescent-reported mean SRP intensity and parent/caregiver-observed mean SRP behavior frequencies were higher for LLs than ULs, and the level of SRP increased with more physically demanding activities. Conclusion: These data suggest SRP is more common and intense in pediatric CP than generally thought, emphasizing the need for effective, long-term pain management.

PMID: 35342060

15. Neurologic Music Therapy Improves Participation in Children With Severe Cerebral Palsy
Clara Susana Santonja-Medina, Eugenio Marrades-Caballero, Fernando Santonja-Medina, Jose Manuel Sanz-Mengibar

Front Neurol. 2022 Mar 9;13:795533. doi: 10.3389/fneur.2022.795533. eCollection 2022.

Positive effects after neurologic music therapy (NMT) have been described regarding the motor function of children with severe cerebral palsy (CP). This study aimed to quantify improvements in participation, as well as complexity on task-related manual activities in children with severe bilateral CP. This analytic quasi-experimental study exposed 17 children with severe cerebral palsy to 13 NMT sessions to improve motor learning through therapeutic instrumental music performance (TIMP), using principally percussion musical instruments. Hoisan software video recording was used to quantify participation involved in creating music. In addition, the number of active movements performed in each NMT session was quantified. Significant improvements were found in the participation variables "visual contact," "motor participation" and "motor participation repetitions." Significant differences were also found in the subcategory "reaching and stroke," "hitting with the hand" and "grasping and hitting." The use of therapeutic of TIMP in children with severe CP improves participation during manual activities utilizing percussion instruments, therefore increasing the intensity of the psychomotor intervention.

PMID: 35356462

16. Does music induce interbrain synchronization between a non-speaking youth with cerebral palsy (CP), a parent, and a neurologic music therapist? A brief report
Kyurim Kang, Silvia Orlandi, Nicole Lorenzen, Tom Chau, Michael H Thaut

Dev Neurorehabil. 2022 Mar 26;1-7. doi: 10.1080/17518423.2022.2051628. Online ahead of print.

Shared emotional experiences during musical activities among musicians can be coupled with brainwave synchronization. For non-speaking individuals with CP, verbal communication may be limited in expressing mutual empathy. Therefore, this case study explored interbrain synchronization among a non-speaking CP (female, 18 yrs), her parent, and a music therapist by measuring their brainwaves simultaneously during four music and four storytelling sessions. In only the youth-parent dyad, we observed a significantly higher level of interbrain synchronization during music rather than story-telling condition. However, in both the youth-parent and youth-therapist dyad, regardless of condition type, significant interbrain synchronization emerged in frontal and temporal lobes in the low-frequency bands, which are associated with socio-emotional responses. Although interbrain synchronization may have been induced by multiple factors (e.g., external stimuli, shared empathetic experiences, and internal physiological rhythms), the music activity setting deserves further study as a potential facilitator of neurophysiological synchrony between youth with CP and caregivers/healthcare providers.

PMID: 35341463

17. Prophylactic cyclo-oxygenase inhibitor drugs for the prevention of morbidity and mortality in preterm infants: a network meta-analysis
Souvik Mitra, Courtney E Gardner, Abigale MacLellan, Tim Disher, Danielle M Styranko, Marsha Campbell-Yeo, Stefan Kuhle, Bradley C Johnston, Jon Dorling

Review Cochrane Database Syst Rev. 2022 Apr 1;4(4):CD013846. doi: 10.1002/14651858.CD013846.pub2.

Background: Patent ductus arteriosus (PDA) is associated with significant morbidity and mortality in preterm infants. Cyclooxygenase inhibitors (COX-I) may prevent PDA-related complications. Controversy exists on which COX-I drug is the most effective and has the best safety profile in preterm infants. Objectives: To compare the effectiveness and safety of prophylactic COX-I drugs and 'no COXI prophylaxis' in preterm infants using a Bayesian network meta-analysis (NMA). Search methods: Searches of Cochrane CENTRAL via Wiley, OVID MEDLINE and Embase via Elsevier were conducted on 9 December 2021. We conducted independent searches of clinical trial registries and conference abstracts; and scanned the reference lists of included trials and related systematic reviews. Selection criteria: We included randomised controlled trials (RCTs) that enrolled preterm or low birth weight infants within the first 72 hours of birth without a prior clinical or echocardiographic diagnosis of PDA and compared prophylactic administration of indomethacin or ibuprofen or acetaminophen versus each other, placebo or no treatment. Data collection and analysis: We used the standard methods of Cochrane Neonatal. We used the GRADE NMA approach to assess the certainty of evidence derived from the NMA for the following outcomes: severe intraventricular haemorrhage (IVH), mortality, surgical or interventional PDA closure, necrotizing enterocolitis (NEC), gastrointestinal perforation, chronic lung disease (CLD) and cerebral palsy (CP). Main results: We included 28 RCTs (3999 preterm infants). Nineteen RCTs (n = 2877) compared prophylactic indomethacin versus placebo/no treatment, 7 RCTs (n = 914) compared prophylactic ibuprofen versus placebo/no treatment and 2 RCTs (n = 208) compared prophylactic acetaminophen versus placebo/no treatment. Nine RCTs were judged to have high risk of bias in one or more domains. We identified two ongoing trials on prophylactic acetaminophen. Bayesian random-effects NMA demonstrated that prophylactic indomethacin probably led to a small reduction in severe IVH (network RR 0.66, 95% Credible Intervals [CrI] 0.49 to 0.87; absolute risk difference [ARD] 43 fewer [95% CrI, 65 fewer to 16 fewer] per 1000; median rank 2, 95% CrI 1-3; moderate-certainty), a moderate reduction in mortality (network RR 0.85, 95% CrI 0.64 to 1.1; ARD 24 fewer [95% CrI, 58 fewer to 16 more] per 1000; median rank 2, 95% CrI 1-4; moderate-certainty) and surgical PDA closure (network RR 0.40, 95% CrI 0.14 to 0.66; ARD 52 fewer [95% CrI, 75 fewer to 30 fewer] per 1000; median rank 2, 95% CrI 1-2; moderate-certainty) compared to placebo. Prophylactic indomethacin resulted in trivial difference in NEC (network RR 0.76, 95% CrI 0.35 to 1.2; ARD 16 fewer [95% CrI, 42 fewer to 13 more] per 1000; median rank 2, 95% CrI 1-3; high-certainty), gastrointestinal perforation (network RR 0.92, 95% CrI 0.11 to 3.9; ARD 4 fewer [95% CrI, 42 fewer to 137 more] per 1000; median rank 1, 95% CrI 1-3; moderate-certainty) or CP (network RR 0.97, 95% CrI 0.44 to 2.1; ARD 3 fewer [95% CrI, 62 fewer to 121 more] per 1000; median rank 2, 95% CrI 1-3; low-certainty) and may result in a small increase in CLD (network RR 1.10, 95% CrI 0.93 to 1.3; ARD 36 more [95% CrI, 25 fewer to 108 more] per 1000; median rank 3, 95% CrI 1-3; low-certainty). Prophylactic ibuprofen probably led to a small reduction in severe IVH (network RR 0.69, 95% CrI 0.41 to 1.14; ARD 39 fewer [95% CrI, 75 fewer to 18 more] per 1000; median rank 2, 95% CrI 1-4; moderate-certainty) and moderate reduction in surgical PDA closure (network RR 0.24, 95% CrI 0.06 to 0.64; ARD 66 fewer [95% CrI, from 82 fewer to 31 fewer] per 1000; median rank 1, 95% CrI 1-2; moderate-certainty) compared to placebo. Prophylactic ibuprofen may result in moderate reduction in mortality (network RR 0.83, 95% CrI 0.57 to 1.2; ARD 27 fewer [95% CrI, from 69 fewer to 32 more] per 1000; median rank 2, 95% CrI 1-4; low-certainty) and leads to trivial difference in NEC (network RR 0.73, 95% CrI 0.31 to 1.4; ARD 18 fewer [95% CrI, from 45 fewer to 26 more] per 1000; median rank 1, 95% CrI 1-3; high-certainty), or CLD (network RR 1.00, 95% CrI 0.83 to 1.3; ARD 0 fewer [95% CrI, from 61 fewer to 108 more] per 1000; median rank 2, 95% CrI 1-3; low-certainty). The evidence is very uncertain on effect of ibuprofen on gastrointestinal perforation (network RR 2.6, 95% CrI 0.42 to 20.0; ARD 76 more [95% CrI, from 27 fewer to 897 more] per 1000; median rank 3, 95% CrI 1-3; very low-certainty). The evidence is very uncertain on the effect of prophylactic acetaminophen on severe IVH (network RR 1.17, 95% CrI 0.04 to 55.2; ARD 22 more [95% CrI, from 122 fewer to 1000 more] per 1000; median rank 4, 95% CrI 1-4; very low-certainty), mortality (network RR 0.49, 95% CrI 0.16 to 1.4; ARD 82 fewer [95% CrI, from 135 fewer to 64 more] per 1000; median rank 1, 95% CrI 1-4; very low-certainty), or CP (network RR 0.36, 95% CrI 0.01 to 6.3; ARD 70 fewer [95% CrI, from 109 fewer to 583 more] per 1000; median rank 1, 95% CrI 1-3; very low-certainty). In summary, based on ranking statistics, both indomethacin and ibuprofen were equally effective (median ranks 2 respectively) in reducing severe IVH and mortality. Ibuprofen (median rank 1) was more effective than indomethacin in reducing surgical PDA ligation (median rank 2). However, no statistically-significant differences were observed between the COX-I drugs for any of the relevant outcomes. Authors' conclusions: Prophylactic indomethacin probably results in a small reduction in severe IVH and moderate reduction in mortality and surgical PDA closure (moderate-certainty), may result in a small increase in CLD (low-certainty) and results in trivial differences in NEC (high-certainty), gastrointestinal perforation (moderate-certainty) and cerebral palsy (low-certainty). Prophylactic ibuprofen probably results in a small reduction in severe IVH and moderate reduction in surgical PDA closure (moderate-certainty), may result in a moderate reduction in mortality (low-certainty) and trivial differences in CLD (low-certainty) and NEC (high-certainty). The evidence is very uncertain about the effect of acetaminophen on any of the clinically-relevant outcomes.

PMID: 35363893

18. Infantile survival and neurodevelopment at three years of age on delivery by the intended delivery mode in extremely preterm infants

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Objective: To elucidate the impact of the intended delivery mode on long-term outcomes among extremely preterm infants. Materials and methods: Women who delivered singletons between 23 0/7 and 25 6/7 weeks of gestation from January 2010 to March 2014 and their infants were included in this study. The cases of fetal growth restriction and those with a chromosomal or major structural abnormality were excluded. The cases of fetal death that was diagnosed before labor onset and cases of non-reassuring fetal status, placental abruptions or umbilical cord prolapse that was diagnosed at labor onset were also excluded. The primary outcome was the incidence of composite adverse events, including death, cerebral palsy, or neurodevelopmental delay, at the age of three years. The composite adverse events, including death, grade III or IV intraventricular hemorrhage, cystic periventricular leukomalacia, necrotizing enterocolitis, focal intestinal perforation, and sepsis of neonatal period, were assessed as short-term outcomes. The association between the intended delivery mode and primary outcome, short-term outcome, and each component was analyzed using a multivariate logistic regression model. Results: Eighty cases were included in the analyses. Primary outcomes could be assessed in 72 cases. Infantile composite adverse events before discharge were observed in 19 cases (24%). The prevalence of primary outcomes was 40% (29 cases). The intended delivery mode was not associated with primary and short-term outcomes and each component complication. Conclusion: An advantage of intended cesarean delivery in terms of prognosis at three years of age in extremely preterm infants was not observed.

PMID: 35361393

19. Understanding Acceptability, Barriers, and Facilitators to Clinical Implementation of the on Track Developmental Monitoring System for Children with Cerebral Palsy: A Qualitative Study

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Aims: On Track Developmental Monitoring System (DMS) is a novel series of tools to assist in shared-decision making, guide rehabilitation intervention based on functional ability levels, and promote episodic care service models. Further understanding of the acceptability, feasibility, and appropriateness of On Track DMS in clinical settings is critical. The purpose of this study was to understand clinician perspectives of the acceptability of On Track DMS and to identify potential implementation barriers and facilitators within pediatric physical therapist practice. Methods: Three, day-long training workshops were conducted with 32 pediatric physical therapists across the US. Focus groups with 21 workshop participants were conducted following training. Results were audio recorded, transcribed verbatim, and coded into themes. Results: Three themes emerged from the data: (1) Valuing the On Track Approach to Intervention; (2) Setting-Specific Needs and Challenges to Implementation; and (3) Training Material/Tool Strengths and Limitations. Conclusions: On Track DMS appears to have initial value and acceptability for pediatric physical therapists across practice settings. Perceived benefits include facilitation of data-driven practice and therapist/family collaboration to improve health outcomes for children with CP. Using this data to understand and assess barriers and facilitators to knowledge use are first steps in successfully implementing On Track DMS.

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20. Do supports and barriers to routine clinical assessment for children with cerebral palsy change over time? A mixed methods study

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Purpose: To understand how healthcare professionals' perceptions of supports and barriers to routine clinical assessment, for children aged 3-18 years with cerebral palsy, evolved in the presence of a knowledge translation intervention. Methods: A prospective longitudinal mixed-methods study was completed. The intervention comprised knowledge brokers, an e-evidence library, locally provided education and embedding routine clinical assessment in practice. Healthcare professionals from five disability services completed the Supports and Barriers Questionnaire and focus groups at baseline, 6, 12 and 24 months. Quantitative data were analysed descriptively and qualitative data using longitudinal framework analysis. Results: Questionnaire ratings indicated participants felt supported in implementing routine assessment over time. Subtle differences emerged from the longitudinal framework analysis. Participants shifted from 'adopting' to 'embedding' and 'maintaining' routine assessment. Integration of assessment was impacted by a new national disability funding model. Participants highlighted the

need to maintain skills and for unambiguous, sustained communication between the organisation, clients, and stakeholders. If, how and why families engaged with routine assessment developed over time. Conclusions: After an initial focus on pragmatic implementation issues, over time healthcare professionals began to reflect more on the complexities of children and families' engagement with assessment and the impact on the therapist-child-family relationship. Trial registration: This trial was not a controlled healthcare intervention and was registered retrospectively: ACTRN12616001616460. The protocol of the trial was published in 2015. IMPLICATIONS FOR REHABILITATION: Healthcare professionals can be supported over time to embed routine clinical assessment using multifaceted knowledge translation interventions. It takes time and ongoing support for healthcare professionals to embed, maintain and begin to adapt the routine clinical assessment to fit with policy, organisational context and the needs and wishes of children and families. Understanding and tailoring knowledge translation approaches to the policy context are essential. Even in the context of major policy shifts, it is possible to harness the commitment of organisations and professionals to improve their services in line with evidence-based approaches.

PMID: 35343348

21. Telehealth Program for Infants at Risk of Cerebral Palsy during the Covid-19 Pandemic: A Pre-post Feasibility Experimental Study
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Phys Occup Ther Pediatr. 2022 Mar 27;1-20. doi: 10.1080/01942638.2022.2057209. Online ahead of print.

Aim: To verify the effects of a telerehabilitation program for infants at high risk for Cerebral Palsy (CP) during the COVID-19 pandemic. Method: Longitudinal study. Infants were aged 3-18 months corrected age, at risk of developmental delay. The General Movement Assessment or a neurologic examination were performed to identify the risk of CP. Motor function was assessed using the Gross Motor Function Measure-88 (GMFM-88) and the Alberta Infant Motor Scale (AIMS). Caregivers of infants at high risk of CP applied a home-based program supervised by a Physical therapist, five times a week over 12 weeks. The program included guidance for optimal positioning, optimization of goal-directed activities, environmental enrichment, and educational strategies. Results: 100 infants at risk for delayed motor development were recruited. Eighteen infants were classified at high risk of CP, and 10 families completed telerehabilitation (83% final retention rate). No adverse events were reported. Adherence to the telecare program was high (90%). The costs were low. We found increased scores for all dimensions and the total score of the GMFM-88, and the AIMS percentile at the end of the intervention. Most infants presented a clinically significant change for the GMFM-88.Conclusions: The telecare program was feasible.

PMID: 35341469

22. Effect of crawling training on the cognitive function of children with cerebral palsy
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Our aim is to investigate the influence of crawling training on the cognitive function of patients with cerebral palsy. This study compared the clinical efficacy of crawling training on 36 patients with cerebral palsy (the experimental group) and 32 patients treated with normal movement training (the control group). We compared the crawling function (The Movement Function Scale for Infants with Cerebral Palsy), cognitive and language function (The Comprehensive Functional Rating Scale for Children with Disabilities), intelligence [IQ and DQ scores in the Chinese Wechsler Intelligence Scale for Children (C-WISC)], memory and attention (the attention/nondistraction factor in the C-WISC) changes of the children before and after treatment. The total treatment efficiency of the experimental group was significantly higher than that of the control group (94.44 vs. 71.87%, $P = 0.012$). The scores for crawling function, cognitive and language functions, intelligence quotient, development quotient and attention factor increased notably in both groups after treatment, and there was a statistical difference compared with the scores of each group before treatment ($P < 0.05$ for all). After treatment, the scores of the experimental group were significantly higher than those of the control group. Crawling training has good clinical efficacy for patients with cerebral palsy. It can improve patients' crawling, cognitive and language functions as well as their intelligence, memory and attention, and it has value for clinical application.

PMID: 35347101

23. Mediating effects of post-fracture cardiorespiratory disease on mortality for adults with cerebral palsy: a cohort study
Daniel G Whitney

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PMID: 35351653

24. eLearning significantly improves maternity professionals' knowledge of the congenital cytomegalovirus prevention guidelines
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Aust N Z J Obstet Gynaecol. 2022 Mar 29. doi: 10.1111/ajo.13500. Online ahead of print.

Aims: Cytomegalovirus (CMV) is a preventable cause of neurodevelopmental disability. Australian guidelines recommend that pregnant women are informed about CMV to reduce their risk of infection; however, less than 10% of maternity health professionals routinely provide prevention advice. The aim was to develop and evaluate the effectiveness of an eLearning course for midwives to improve knowledge and confidence about CMV. Materials and methods: Participants undertaking the course between March and November 2020 were invited to complete an evaluation questionnaire: before the course (T1), immediately after (T2) and three months post completion (T3). A linear mixed model was used to evaluate change in participant scores; $P < 0.05$ was considered statistically significant. Results: Midwives (316/363, 87%), midwifery students (29/363, 8%) and nurses (18/363, 5%) participated. At T1 80% indicated they had not received education about CMV. Total adjusted mean scores for questionnaires completed between T1 (n = 363) and T2 (n = 238) increased significantly (from 17.2 to 22.8, $P < 0.001$). Limited available T3 scores (n = 27) (-1.7, $P < 0.001$), while lower than T2, remained higher than at T1 (+3.6, $P < 0.001$). Participants' awareness of CMV information resources improved from 10 to 97% from T1 to T2. Confidence in providing CMV advice increased from 6 to 95% between T1 and T2 ($P < 0.001$) and was maintained at T3. Almost all (99%) participants indicated they would recommend the course to colleagues. Conclusion: Participants who completed the eLearning course had significantly improved knowledge and confidence in providing advice about CMV. Programs targeting other maternity health professionals should be considered, to further support the implementation of the congenital CMV prevention guidelines.

PMID: 35348198

25. The safety and efficacy of umbilical cord blood mononuclear cells in individuals with spastic cerebral palsy: a randomized double-blind sham-controlled clinical trial
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Randomized Controlled Trial BMC Neurol. 2022 Mar 29;22(1):123. doi: 10.1186/s12883-022-02636-y.

Introduction: The current multi-center, randomized, double-blind study was conducted among children with cerebral palsy (CP) to assess the safety and efficacy of umbilical cord blood mononuclear cell (UCB-MNC). We performed the diffusion tensor imaging to assess the changes in the white matter structure. Methods: Males and females aged 4 to 14 years old with spastic CP were included. Eligible participants were allocated in 4:1 ratio to be in the experimental or control groups; respectively. Individuals who were assigned in UCB-MNC group were tested for human leukocyte antigen (HLA) and fully-matched

individuals were treated with UCB-MNCs. A single dose (5 × 106 /kg) UCB-MNCs were administered via intrathecal route in experimental group. The changes in gross motor function measure (GMFM)-66 from baseline to one year after treatment were the primary endpoints. The mean changes in modified Ashworth scale (MAS), pediatric evaluation of disability inventory (PEDI), and CP quality of life (CP-QoL) were also evaluated and compared between groups. The mean changes in fractional anisotropy (FA) and mean diffusivity (MD) of corticospinal tract (CST) and posterior thalamic radiation (PTR) were the secondary endpoints. Adverse events were safety endpoint. Results: There were 72 included individuals (36 cases in each group). The mean GMFM-66 scores increased in experimental group; compared to baseline (+ 9.62; 95%CI: 6.75, 12.49) and control arm (β: 7.10; 95%CI: 2.08, 12.76; Cohen's d: 0.62) and mean MAS reduced in individuals treated with UCB-MNCs compared to the baseline (-0.87; 95%CI: -1.2, -0.54) and control group (β: -0.58; 95%CI: -1.18, -0.11; Cohen's d: 0.36). The mean PEDI scores and mean CP-QoL scores in two domains were higher in the experimental group compared to the control. The imaging data indicated that mean FA increased and MD decreased in participants of UCB-MNC group indicating improvements in white matter structure. Lower back pain, headaches, and irritability were the most common adverse events within 24 h of treatment that were related to lumbar puncture. No side effects were observed during follow-up. Conclusions: This trial showed that intrathecal injection of UCB-MNCs were safe and effective in children with CP. Trial registration: The study was registered with ClinicalTrials.gov (NCT03795974).

PMID: 35351020